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PROTECTING AGAINST TRANSIT CRIME: THE IMPORTANCE OF THE BUILT ENVIRONMENT

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This chapter deals with an important citizen right: the ability to walk from home or work to the transit stop, or wait at a bus stop or on a station platform without the fear of being victimized. Crime and fear of crime unfortunately affect many aspects of everyday life in our cities. Transit crime is a rather persistent but underreported trend that scares and intimidates riders – particularly women. The majority of incidents represent public nuisance crimes. The majority of the victims are captive transit riders, frequently immigrant and poor. In Los Angeles some of the victims are even afraid to report transit crimes to the authorities lest they expose their illegal-resident status.

In this chapter, we want to argue that planners and policy makers need to often scratch beyond the surface of official numbers and crime statistics. At the same time, relying on one theory to understand a complex urban phenomenon, such as crime, may often prove inadequate. In our case, we found two seemingly antithetical theories useful, but still needing validation with empirical data: compositional theories that cast attention on offenders, and ecological theories that focus on the context of crime. We discovered that to understand a problem that is largely invisible to authorities, we had to rely not only on crime reports but also extensive fieldwork, to combine quantitative and qualitative techniques, and go from the macro to the micro, from census data to first-hand observation, and surveys of riders.

Horst Rittel and Mel Webber have once proclaimed that planning deals with “wicked” problems (1973). There is nothing more wicked than crime. We would argue that our field could better conceptualize wicked problems if it integrates and utilizes knowledge from other fields. For our research we relied extensively on criminological studies to understand what causes transit crime. But understanding the roots of a problem is only a first, albeit necessary step towards mitigation. Planning is an applied profession and planners are not content to only theorize and understand the roots of urban problems; they also want to do something about them. Our findings that show a linkage between social and physical characteristics of neighborhoods and transit crime point to the need for a multi-pronged approach for the mitigation of transit crime. Some of the “prongs” may be well outside the reach of planning, as planners and transportation authorities cannot necessarily deal with all the social variables that affect transit crime. However, the design of the built environment, the mix of land uses, the physical characteristics of place have also an effect on crime—and these characteristics can be tackled by planners.

This chapter represents a synthesis of our work on transit crime (Loukaitou-Sideris, 1999; Loukaitou-Sideris, Liggett, and Iseki, 2001; 2002; Liggett, Loukaitou-Sideris, and Iseki, 2001; 2003). We first summarize the theoretical context of our studies, referring to two types of criminological theories that seek to explain the incidence of crime. We give particular emphasis to ecological theories which examine the link between the physical

environment and crime, but we also discuss the crime implications of the different sociodemographic characteristics of station neighborhoods. Following this brief theoretical overview we present our empirical findings about the effect of the built environment on crime at transit stops and stations in Los Angeles. We end the chapter by discussing policy recommendations and suggestions for safer transit stops and stations.

Compositional Versus Ecological Theories

Many studies have documented transit crime, but most have focused their attention on the social variables of crime: the sociodemographic characteristics of offenders and victims and the social context of transit stop or station neighborhoods. With few exceptions (Block and Block 2000; Block and Davis 1996; Loukaitou-Sideris and Banerjee 2000; our other papers), researchers have ignored the spatial environment (type of land uses, urban form attributes) in the immediate vicinity of transit stops and stations. This is not consistent with recent developments in criminology which have increasingly become aware of the importance of place as a setting for crime. A place is a very small area, a street corner, an intersection, a bus stop, or a transit station. Criminologists have noticed that crime often tends to concentrate heavily and disproportionately in a few places, or “hot spots.” Such observations have led to arguments for reorientation of crime prevention efforts and a focus on the environmental context of crime instead of the socio-demographic characteristics of the offenders.

This debate underlines two distinct approaches in crime research studies (see Table 1). So-called compositional or non-ecological studies stress the importance of the offenders’ sociodemographic characteristics. Therefore, these studies seek to identify relationships between a neighborhood’s crime level and the characteristics of race and ethnicity, age and gender, poverty levels, and social mobility of inhabitants. In contrast, ecological studies focus on physical attributes as covariates of crime. For such studies, it is the location and physical context of crime – not the sociodemographic characteristics of the offenders—that acquire significance. Of particular interest are place characteristics (land uses, built-form condition, visibility levels), as well as a site’s access characteristics.

Clearly, the two approaches of crime research lead to different types of crime prevention strategies. Compositional studies target the potential offenders. They advocate social and educational services to tackle teenage delinquency and recidivism. They argue for changes in the system of policing (e.g., community policing) and reformulation of the criminal justice and penal systems to address crime. In contrast, ecological studies focus on the manipulation of physical and environmental characteristics for the mitigation of crime. Implicit in such studies is the belief that the redesign or transformation of certain place characteristics can lead to lower levels of crime. These efforts are called “situational” because they link criminal activities to the specific physical attributes of hot spots. Ecological studies lead to crime prevention efforts that use environmental design as a tool for “designing out” crime. Before such design efforts and prevention policies are implemented, however, the different physical attributes that can encourage or discourage crime must be clearly understood. Our research falls primarily in the ecological category and is intended to identify and objectively measure environmental variables specifically associated with bus stops and stations, which affect the spatial concentration of transit crime.

Table 1: Crime Studies

<u>Ecological</u>	<u>Compositional</u>
● Importance of physical and ecological attributes ● Study of the environmental context	● Importance of socio-demographic attributes (age, ethnicity, gender, class, social mobility) ● Study of offenders
↓	↓
<u>Crime Prevention Strategies</u>	
● Target: Environmental Context (“designing out crime”) ● Situational crime prevention ● Crime Prevention Through Environmental Design (CPTED)	● Target: Potential offenders ● Social/educational services ● Policing ● Criminal Justice

Environment and Crime

We have drawn from a stream of research that has been concerned with identifying the physical factors that form the ‘environmental backcloth’ and which may generate opportunities for crime (Brantingham and Brantingham, 1993; Perkins et al, 1992; Taylor et al, 1980). The literature has shown that certain physical attributes such as ‘negative’ land uses, street layouts that create multiple escape routes, environmental disrepair and desolation, and physical features that block visibility and natural surveillance can encourage higher incidence of crime.

According to researchers the design of the built environment can affect crime through its effect on the degree of access, ease of entrance and exit, and surveillability (Greenberg and Rohe, 1984). For example, alleys and mid-block connections increase the number of escape routes, open a block or a neighborhood to exploration, and aggravate the criminal risk for residential or commercial establishments (Brantingham and Brantingham, 1993).

The type of surrounding land uses has been found to have a major effect on the incidence of crime. As early as 1929, Shaw and McKay had noted that commercial and industrial areas were prominent features of neighborhoods with high residential delinquency (Shaw and McKay, 1929). A much later study that examined the relationship between land use and crime in the District of Columbia found that the commercial and transitional areas tended to be more attractive targets for criminals, followed by industrial areas, with residential areas considered as the least attractive. Multifamily housing areas are typically found to be more susceptible to crime than single-family housing (Rhodes and Conly, 1981). The percentage of lots zoned for

commercial use was a significant predictor of increased risk of high robbery rates in Washington, DC (Harrell and Jouvis, 1994, in Taylor and Harrell, 1996).

Specific commercial uses are more likely to generate crime than others, especially if there is a high concentration of them in a limited area. The presence of a great number of liquor stores, bars, and taverns can have a negative effect on neighborhood crime (Block and Block, 1995). Consumption of alcohol frequently affects aggression and increases willingness to take risks, thus facilitating criminal behavior (Fagan, 1990). Patrons of establishments in which cash transactions take place (pawnshops, check-cashing facilities, ATMs) are likely targets. Areas with vacant lots or buildings, public parks, and schools often attract youth and gang-related crime (Perkins et al, 1992).

In addition to access opportunities and 'negative' land uses, the level of physical disrepair and deterioration in an area seems to be related to crime incidence. Skogan (1990) and Wilson and Kelling (1982) have argued that physical incivilities (trash, graffiti, abandoned buildings, disrepair, unkempt lots) and social incivilities (rowdy behavior, drug dealing, public drunkenness, prostitution, panhandling, and loitering) result in higher crime and resident fear. The relationship of physical incivilities to crime is expressed in the 'broken window' thesis, popularized by Wilson and Kelling (1982). A broken window left unrepaired implies that social control is weak in an area. Potential offenders are more likely to act if they believe that no one is in control. Most relevant studies have measured *perceived* incivilities and have not developed objective measures of physical incivilities (Perkins et al, 1992).

Offenders want to avoid the risk of being seen while committing a crime. The possibility of surveillance by shop owners, managers, employees, guards, or caretakers has been found to have a strong effect in reducing crime (Brantingham and Brantingham, 1993). Surveillance is dependent on visibility, which in turn is determined by good lighting at night, unobstructed lines of sight through windows, and from neighboring buildings and streets (Rand, 1983). Thus, the presence of physical features that increase the visibility of a site (such as open storefronts, unobstructed windows, and well-lit areas) and the absence of features that can block views (for example, blank walls, thick vegetation) can help ameliorate crime.

The relationship between density and crime has been quite ambiguous. Jacobs's (1961) prescription of 'eyes on the street' as a deterrent to criminal activity has been questioned by researchers who argued that high levels of activity do not necessarily imply adequate surveillance (Mayhew, 1981). Some studies even found levels of pedestrian and vehicular traffic to be negatively related to the incidence of certain crimes (Duffala, 1976; Pablant and Baxter, 1975). In a study of the ten most dangerous bus stops in Los Angeles we found that certain types of crime were more likely to happen in desolate areas, whereas other types of crime typically took place in situations of high density when the potential offender could easily hide in the crowd (Loukaitou-Sideris, 1999).

In spite of the considerable number of theoretical and empirical studies in which the link between physical environment and crime has been investigated, most studies have not shown which environmental variables affect which types of crimes. For classification purposes the Federal Bureau of Investigation (FBI) has classified crime into two major categories: Type 1 crime (criminal homicide, forcible rape, robbery, aggravated assault, larceny theft, burglary, grand auto theft, arson), and Type 2 crime (crime of less serious nature against people and their property, such as petty theft, disorderly conduct, vagrancy, non-aggravated assaults, drug violations, vandalism, etc). Some types of crime in the Type 2 category are characterized as public nuisance crime. Although of a less serious nature, public nuisance crime can be very intimidating for transit riders. Such incidents (public drinking, obscene language, disorderly conduct) made up most of the crime reported in our bus stop studies while vandalism was the most frequent crime at the transit stations. In our study, we sought to identify the particular variables that are relevant for serious crime, as well as the variables which seem to encourage public nuisance crime.

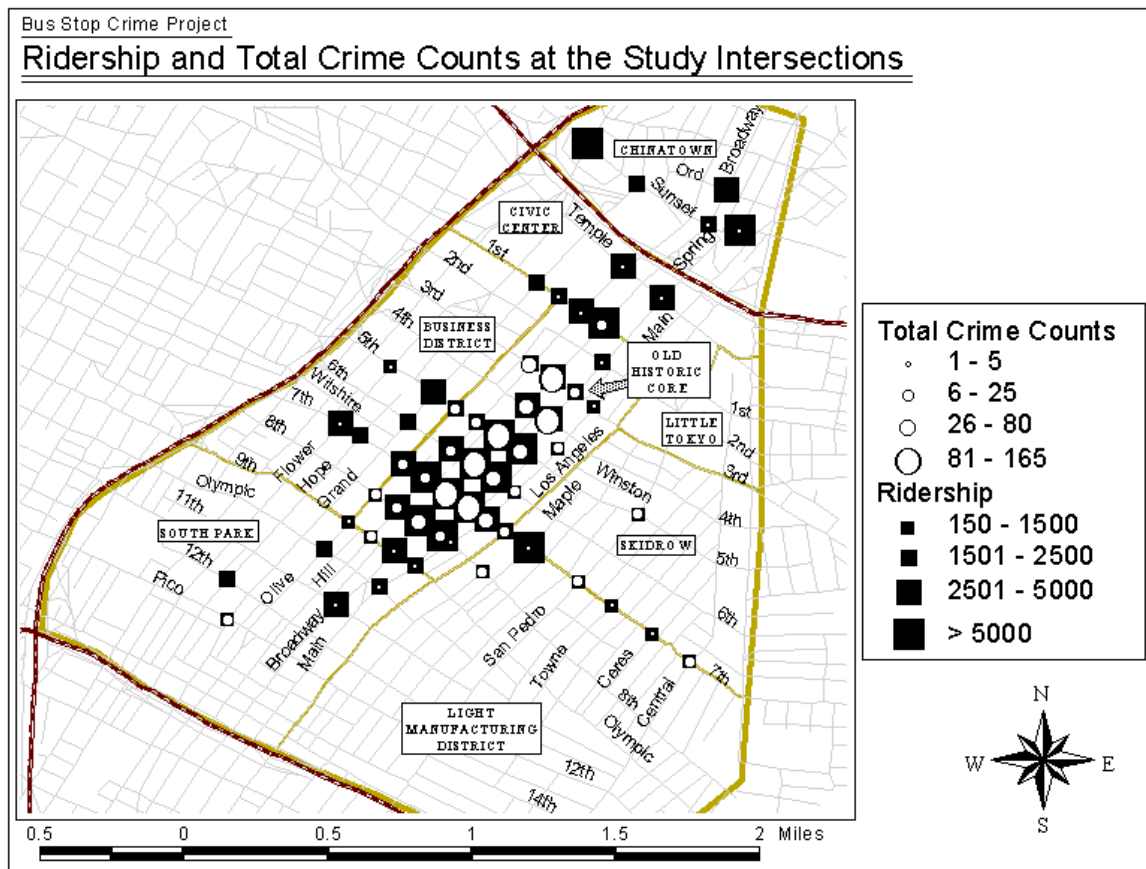
Few researchers have measured the physical environment directly and objectively, preferring instead to utilize subjective perception surveys (Perkins et al, 1993). Yet some have argued that crime indicators can be better predicted by objective measures of the environment rather than by studies of social perception (Gifford, 1993). In our studies we have sought to measure different environmental attributes around transit stops and stations in Los Angeles using objective measures of crime indicators. We have focused on two types of public transportation most relevant to the Los Angeles region – bus and light rail.

Transit Crime in Los Angeles

The Setting: Bus Stops and Light Rail Stations. Bus stop crime in Los Angeles is highly concentrated spatially, with the vast majority of crime incidents committed in the downtown area and its adjacent neighborhoods to the west. To explore the impact of environmental characteristics on bus stop crime, we focused on a sample of 100 intersections with bus stops in both downtown Los Angeles and in the adjoining neighborhoods of Pico Union and Westlake. The map displayed in Figure 1 shows crime and ridership levels for the bus stops in our sample, which were located in downtown Los Angeles. The high-crime bus stops were concentrated along certain main streets in what is considered the old historic core and skidrow areas of downtown, as well as along a major artery in the outlying Pico Union neighborhood.

Our crime database consisted of 2,805 bus stop crimes (crimes against people who were waiting for a bus or who had just come off a bus). The data was collected by the Los Angeles Metropolitan Transportation Authority (MTA) and the Los Angeles Police Department from 1994 to 1998. About three-fourths of the crime incidents were Type 2 crimes while just 577 were Type 1 crimes. Ridership was based on data also obtained from the MTA and was calculated as the daily average numbers of passenger boardings and alightings per bus stop. Crime data at each bus stop were normalized by ridership (i.e. crimes per rider). Ridership ranged from a minimum of 158 riders per day

to a maximum of almost 13,000. Over eighty percent of the bus stops had less than 5,000 riders per day, while only two had more than 10,000 daily riders.

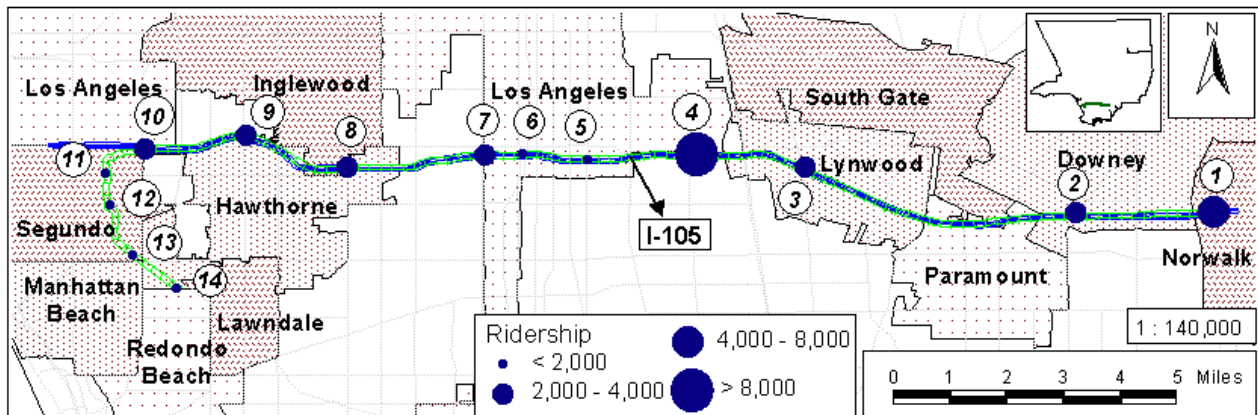


We used the Los Angeles Green Line as a case study to explore how the different physical and social characteristics at the station and neighborhood affect station crime. The Green Line is a light-rail line that runs for 19.6 miles from Norwalk to El Segundo in Los Angeles County (see Figure 2). The line has fourteen stations and twenty-four separate parking lots and had an average weekday ridership of 26,894 passengers in 1999. This is a small and simple light-rail system that started operating in August 1995. The Green Line represents a good case to study the relationship between different socio-spatial variables and the incidence of crime since the fourteen station neighborhoods vary significantly in terms of their surrounding land uses and environmental conditions. The station neighborhoods also vary in regard to their sociodemographic characteristics. Neighborhoods at the western end of the line are more affluent than the inner-city neighborhoods in the middle. Neighborhoods at the eastern end can be characterized as middle class. They are ethnically more heterogeneous than the neighborhoods at the western end, which are primarily white.

We obtained crime data for the Green Line from the Transit Services Bureau of the Los Angeles County Sheriff's Department from 1998 onward and ridership data for

all Green Line stations from the Los Angeles County Metropolitan Transportation Authority (MTA). Sixty-eight percent of crimes at the transit stations fell into the Type 2 category and consisted primarily of vandalism. Most of the serious crime at stations

Figure 2: Location of Green Line Stations with Ridership Levels



took place in the park-and-ride lots (motor vehicle theft and burglary/theft from vehicles) followed by crimes on the platform (robbery and assault against persons). There was no reported homicide and only one rape.

The Unit of Analysis: Place vs. Space. Criminologists discuss the link between place and space, and argue that certain criminogenic factors may be rooted in either place or space attributes. They define places as “points in space” (for example, an intersection, a building, a park), and spaces as “two-dimensional areas that contain the events, specific situations, and special attributes characteristic of places” (Block and Block, 1995, page 146). While operationally the scale of our data collection for the two types of studies differed, we collected data both at the space level, the neighborhood surrounding the bus stop or transit station, and at the place level, the immediate bus stop or transit station environment. For the bus stop studies, a place represented the intersection where the bus stop was located, while the space was defined as a 150-foot radius around the intersection (basically ½ block in either direction). The space (or neighborhood) for the transit station studies was considered to be ¼ mile radius around the station. In both types of studies we conducted a systematic and detailed fieldwork analysis and photographic documentation of the environment around the transit station or stop and compiled an inventory of environmental data and attributes that other studies have shown to be related to crime incidence.

The Effect of Physical Characteristics on Crime. The environmental inventory data were collected by researchers who visited each transit site and mapped and recorded information concerning physical conditions. Data were collected for three groups of physical characteristics: (a) urban form characteristics around transit stops, such as land uses, the overall condition of the surrounding neighborhood, and the concentration of

undesirable places (e.g., bars, liquor stores, pawnshops, etc.); (b) stop or station characteristics, such as the existence of bus shelters or the layout of the station platform, the degree of formal or informal surveillance, the visibility and lighting at bus stops or station platforms and park-and-ride lots; and (c) street characteristics, such as on-street parking and pedestrian and vehicular traffic levels. Table 2 lists the environmental variables measured for each study. Correlation studies led to a number of conclusions about the relationship of certain physical attributes and bus stop or transit station crime, summarized in Tables 3 and 4.

Our analysis revealed that certain urban form and bus stop characteristics influence transit crime. For example, crime rates were higher at bus stops in areas with alleys and mid-block passages (corroborating the idea that crime is high where there are avenues for escape) and near multi-family housing, liquor stores, check-cashing establishments, vacant buildings, and buildings marked by graffiti and litter. For violent (Type 1) crimes in particular, we found that the location of check-cashing establishments near bus stops and the presence of alleys had the strongest positive correlation with crime rates.

Table 2: Environmental Indicators Measured

Bus Stops Urban Form Characteristics <i>Factors Facilitating Escape</i> Alley/Mid-block Connection <i>Land Use</i> Single-family Residential Multi-family Residential Small/Open-Air Commercial Small/Closed Front Commercial Liquor Stores Check Cashing Establishments Adult Movie Theatres Adult Book Stores Surface Parking Lot Parking Structure <i>Condition</i> Vacant Lots Vacant Buildings Run-down Establishments Graffiti-litter		Street Characteristics Street Vehicle Traffic On-street Parking Bus Stop Characteristics Visibility Lighting Public Phones Bus Shelters Visible Caretaker/Guard Police Substation Pedestrian Presence
Transit Stations Urban Form Characteristics <i>Land Use</i> Single-family Residential Multi-family Residential Mixed Use Office (low, medium, or high rise) Retail neighborhood Retail "Big Box" Industrial (light or heavy) Vacant Land Surface Parking Lot Parking Structure Open Space (e.g. parks) Specific Land Use Liquor Stores, Pawn Shops, Check Cashing Establishments, Parks, Schools, Restaurants, Cafes, Hotels, Motels, Banks/ATMs, Civiv Buildings <i>Condition</i> Density Vacant Buildings Building Stock Condition (Poor, Average, Good) Neighborhood Condition (Blighted, Average, Well-kept) Dynamics of Neighborhood (Decaying, Stable, Prosperous) Sense of Safety (Good, Average, Poor)		Street Characteristics Street Vehicle Traffic Pedestrian Traffic (adjacent to station) Station Characteristics <i>Park N Ride Lots</i> Distance from Platform Lighting Fencing Security Guards Pedestrian Presence Utilization Linkage to Platform Graffiti-Litter <i>Platform</i> Type (Street Level, Overpass, Underpass) Lighting Security Guards/Police Officers Pedestrian Presence Linkage to Street Graffiti-Litter Visibility from Surroundings Hiding Places

Table 3: Environmental Variables Related to Bus Stop Crime

Variables Associated with Higher Crime Rates	Variables Associated with Lower Crime Rates
1- Liquor Stores and Other Undesirable Establishments 2- Vacant Buildings and Lots 3- Rundown Buildings 4- Level of Litter	1- Large/Closed Front Commercial 2- Visibility 3- Bus Shelters 4- Street Traffic 5- Pedestrian Presence

Table 4: Environmental Variables Related to Station Crime

Variables Associated with Higher Crime Rates	Variables Associated with Lower Crime Rates
1- Large Park-and-Ride Lots 2- Underpass Station Design 3- Poor Visibility 4- Residential/Retail Land Use 5- Liquor Stores and Other Undesirable Establishments 6- Graffiti & Litter 7- Deteriorating Buildings	1- Office/Industrial Land Use 2- Well-kept Neighborhood 3- Good Building Stock

Positive environmental factors included good visibility from surrounding establishments and the presence of bus shelters. Pedestrian presence was negatively correlated with bus stop crime rates, indicating lower levels of crime where there were more “eyes on the street” (Jacobs, 1961). Street characteristics such as on-street parking and vehicle traffic seemed to also affect crime rates. Bus stop intersections with on-street parking tended to have higher crime rates (perhaps due to obstruction of visibility), while heavy vehicular traffic was associated with lower crime rates (perhaps similar to pedestrian presence). Photographs in Figure 3 show environments typically associated with high-and-low crime bus stops.



(a) Low Crime bus Stop



(b) High Crime Bus Stop

Figure 3: Typical Low- and High-Crime Bus Stops

Our analysis of transit station crime data showed that Type 1 crime was mostly concentrated at either the park-and-ride lots (60 percent) or on station platforms (about 20 percent). Type 2 crimes were predominantly in the access routes to the platform from the parking lot or from the street (i.e. stairs, elevators, or escalators). Ninety percent of Type 2 crimes were vandalism, and half of these incidents took place in the access routes.

At park-and-ride lots, a significant correlation was found between the number of parking spaces and crime. Parking lots with litter tended to also concentrate more vandalism. Parking lots appeared to be quite void of pedestrians, and this desolateness seemed to facilitate criminal activity. Dark and desolate parking areas under the freeway projected a feeling of lack of safety (see Figure 4).



Figure 4: Parking Lot in Wilmington Station



Figure 5: Underpass Platform at Lakewood Station

With regard to station design underpass stations tended to have higher crime rates than overpass stations, presumably because of less visibility. A careful examination of the physical environment showed a number of hiding places (under stairways, behind pillars) in the dark underpass stations (see Figure 5). The five stations with the highest platform crime had also minimal visibility from their surroundings (Figure 6), as they were separated from the adjacent neighborhood fabric by a high-speed freeway and interchange ramps. Unlike many light-rail systems that are well integrated in their surroundings, the location of many Green Line platforms in the midst of a freeway negates the potential for natural surveillance from the adjacent neighborhood and increases the level of platform noise.

Crime was higher at stations surrounded by residential land uses and lower at stations with primarily office and industrial uses. This can be explained by the fact that office and industrial areas were also characterized by lower densities than residential areas. Station neighborhoods with significant retail facilities had higher Type 2 crime. As in the case of bus stops, we found that ‘negative’ land uses such as liquor stores, bars and check cashing establishments had a strong positive correlation with Type 2 crimes (see Figure 7). In fact, the highest level of Type 2 crimes was observed in a station that had the highest number of pawnshops and check cashing establishments.



Figure 6: Platform at Long Beach Station



Figure 7: Bar in Vicinity of Long Beach Station

Our fieldwork seemed to support the “broken window” thesis (Wilson and Kelling 1982), that there is a relationship between physical and social incivilities and crime. Station neighborhoods that were considered “decaying” – with littered sidewalks, abundance of graffiti, and deteriorating buildings – also had high numbers of Type 2 crime. In contrast, station neighborhoods considered “prosperous,” “well-kept,” and with good building stock had low crime levels.

The Effect of Sociodemographic Characteristics on Crime

As noted earlier, many researchers have hypothesized that the compositional characteristics of the neighborhood surrounding a transit station (its density, income levels, age and race composition, education level, and unemployment levels of residents) have a likely correlation with transit crime. While we were primarily interested in the effect of environmental characteristics on crime, we recognized the validity of the compositional approach. We therefore investigated the sociodemographic composition of the station neighborhoods and used these factors as controls in multivariate analysis in order to explore relationships of the environmental characteristics with crime.

Table 5: Sociodemographic Variables Related to Station Crime

Variables Associated with Higher Crime Rates	Variables Associated with Lower Crime Rates
1- High Population Density 2- More Persons per Household 3- Younger Population 4- Population with less than High School Education	1- Owner Occupied Units 2- High Income Households 3- White Neighborhoods 4- Population College Educated

Based on 1997 census block group data, we found that station neighborhoods differed significantly in terms of the population living within a half-mile radius of a station. Analysis showed that certain sociodemographic characteristics of the neighborhoods adjacent to the station seem to be related to station crime (Table 5). We

found higher Type 2 crime in station neighborhoods with larger populations (Figure 8), more persons per household, a younger population, and a higher percentage of the population with less than a high school education. Type 2 crime counts were lower at stations where there was a higher percentage of owner-occupied units and a higher percentage of high-income households.

We found more serious crimes against persons in areas with more persons per household, more low-income families (Figure 9), a larger percentage of the population younger than 18, and more population with less than a high school education. There were fewer serious crimes against persons in predominantly white neighborhoods, in areas where more of the population was college educated, and where there was a high percentage of owner-occupied housing.

Figure 8: Type 2 Crime and Population Density

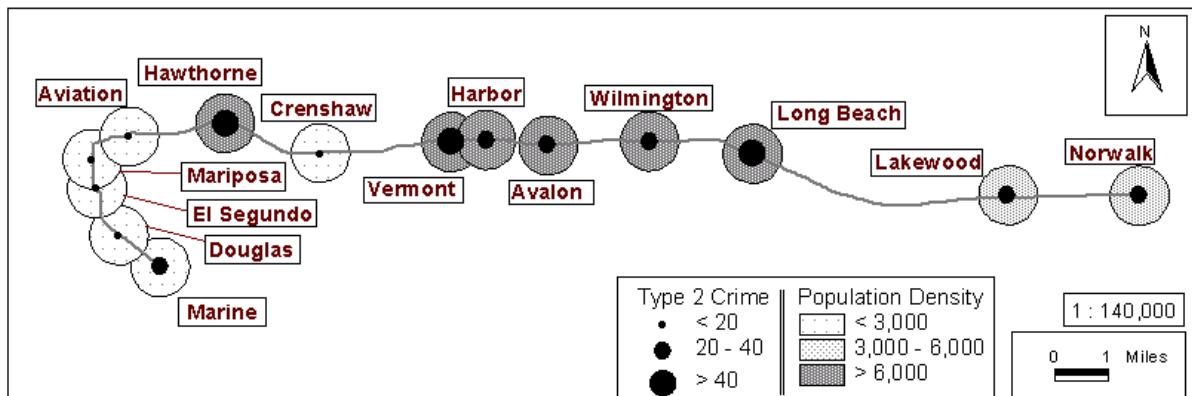
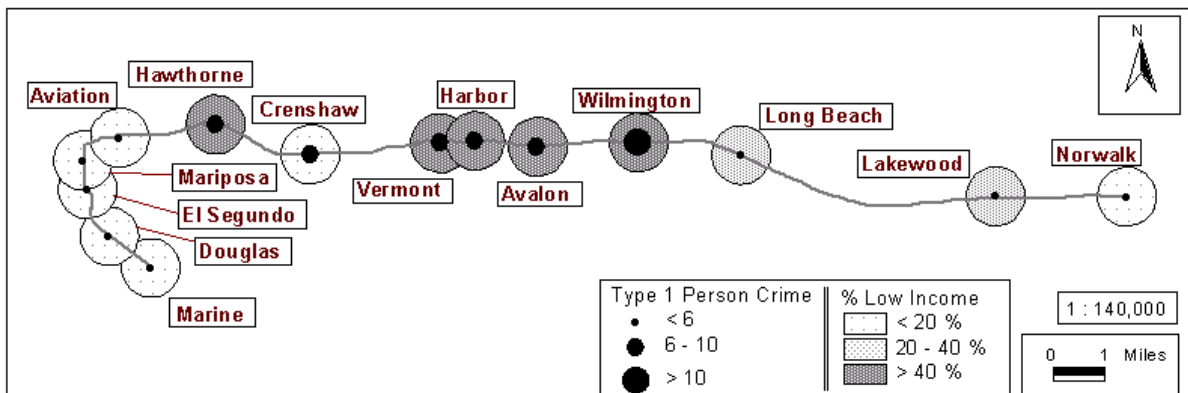


Figure 9: Crime Against Persons and Income



For our bus stop studies the scale of the neighborhood (half a block around the intersection) and the general lack of residential population in downtown precluded a serious analysis of the effects of socioeconomic data. We noted, however, the high concentrations of bus stop crime in localized corridors and used location dummy variables as controls in multi-variate analysis to account for potential sociodemographic effects. We found a very high concentration of the incidence of bus stop crime in one

central zone of downtown Los Angeles that coincided with the city's old historic core. A second (but lighter) concentration extended eastward from the old historic core to the Skidrow District. Downtown Los Angeles has been described as highly polarized (Davis, 1991; Soja, 1991). The spatial contrast between the new and prosperous office district (where we noted low levels of bus stop crime per capita) and the old, decaying part of downtown (where we noted high levels of bus stop crime per capita) is indeed sharp. The two high-crime districts (old Historic Core and Skidrow) also have very high concentrations of dirty streets and alleys, vacant buildings, and negative land uses. After controlling for place we still found that specific environmental variables were related to crime rates – liquor stores and other undesirable facilities and litter result in higher crime rates, whereas visibility and the presence of pedestrians lead to lower crime rates.

Policy Recommendations: How Can We Make Transit Stops and Stations Safer?

Our research gives a clear indication that a combination of social and physical variables at a transit station or stop and its immediate neighborhood affect crime. Most crimes tend to occur in dangerous places. Why these places have a higher crime potential than others can be partly explained by their social and compositional characteristics. But within these dangerous locales that concentrate many hot spots of crime, some spaces are more dangerous than others. At the same time, different types of crime occur under different environmental conditions. At bus stops, serious crimes tend to happen in more isolated situations, while pickpockets seek crowding. At stations, crime at the platforms against people was strongly related to ridership – the busiest stations tended to concentrate the most serious crime.

The design and layout of the physical environment can be conducive to crime or can reduce opportunities for criminal actions. For example, we found many instances of bus stops in the historic core (an area with high crime potential) that were crime ridden, while other bus stops in the same area and along the same bus route were mostly unscathed. On the basis of our findings, it can be concluded that the presence or absence of certain environmental characteristics in the environment of a transit stop can affect the incidence of crime.

While transit authorities cannot deal with many of the social variables that affect crime, our studies pinpoint a number of design and policy implications to tackle the physical variables. For one, the security of transit passengers should extend from the bus stop or station platform (place) to the public environment that surrounds the transit stop (space). Good visibility and pedestrian presence are important variables in reducing crime. Every effort should be made to site bus stops away from desolate spaces, empty lots, and vacant buildings and in front of establishments that offer opportunities for natural surveillance. The placement of bus stops near undesirable establishments (liquor stores, bars, adult bookstores and movie theatres) and near facilities that favor many cash transactions (pawnshops, check-cashing establishments) should be avoided. Sometimes, this may simply mean moving a bus stop a few yards up and down a street or at the opposite corner.

In discussions with MTA representatives about the findings of this research, we discovered that in many cases bus stops were purposely placed near empty lots or vacant buildings as there was less opposition from property owners. We found, however, the MTA very receptive to our recommendations and one immediate action taken was the allocation of \$500,000 in local transportation funds for bus stop safety improvements which included bus stop relocations as well as physical improvements such as shelters and lighting.

Although on-street location of light-rail stations provides opportunities for more visibility from surrounding establishments (Walker 1992), the location of light-rail lines in the freeway median makes this option less viable. Still, appropriate station and parking lot design that eliminates entrapment spots and hiding places and increases visibility through design and adequate lighting can create “defensible space” (Newman 1972), a station environment whose physical attributes contribute to its better security.

A security analysis report was prepared prior to the opening of the Green Line (AEGIR Systems Inc. 1991). This report recognized that security measures needed to be implemented for three areas most at risk: station plaza areas under freeway overcrossings; along routes used by passengers between station plaza areas and parking lots; and in the parking lots adjacent to the stations (all areas we found also to be most at risk). Emphasis in this report was placed, however, on policing these areas rather than on crime prevention through environmental design (CPTED). With the current strain on police resources, it becomes imperative to examine CPTED tools, as complementary to policing. This assertion is supported by our empirical findings that show that certain elements in the design of the built environment can facilitate or discourage crime.

For light-rail stations, the security of park-and-ride lots and of the routes connecting them to the station is very significant. Our studies showed that smaller, well-lit lots that were well integrated to the surrounding urban fabric scored well in terms of security. Increased police patrolling of the lot, possibly paid from parking revenue, could help in the reduction of park-and-ride crime. Also, the incorporation of convenience stores and ticket machines in the parking lot could increase pedestrian presence and reduce car thefts.

Because crime tends to be concentrated disproportionately in specific dangerous locales, a regular security audit by transit authorities will reveal the hot spots of crime at the bus stops or transit stations. This audit could be used to guide a targeted deployment of security personnel to the most dangerous spots during the most dangerous times. For bus stops, specifically, bicycle and foot patrolling by police should reduce opportunities for crime.

The upkeep, good maintenance, and cleanliness of the public environment surrounding the bus stop or station are of paramount importance for the safety of transit passengers. Incidents of vandalism that plague transit systems can be reduced through the use of graffiti and vandal-resistant materials. City agencies should strive to keep the environment free of graffiti and litter, thus sending the message that someone other than the criminal is in control of the transit stop environment.

Finally we hope our research brings a message to transportation authorities that planning and design of a transit system needs to extend beyond the system itself to incorporate the public environments of the transit stop, park-and-ride, overheads and underpasses, and sidewalks leading to the bus stop or station platform. Transit stops and stations are important settings for the many citizens who spend time at them waiting for buses and trains. They should be safe and comfortable. Good planning and design can definitely increase the odds that the trip to home or work will be a safe one.

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